



ICAO ENGINE nvPM EMISSIONS DATA SHEET

SUBSONIC ENGINES

ENGINE IDENTIFICATION: Trent 970-84 BYPASS RATIO (-): 8.5
 UNIQUE ID NUMBER: 01P18RR103 PRESSURE RATIO π_{co} (-): 38.0
 COMBUSTOR: Phase5 Tiled
 ENGINE TYPE: TF RATED OUTPUT F_{oo} (kN): 338.7

REGULATORY DATA

CHARACTERISTIC VALUES:	LTO_{mass}/F_{oo} (mg/kN)	LTO_{num}/F_{oo} (particles/kN)	NVPM MASS CONCENTRATION ($\mu\text{g}/\text{m}^3$)
LTO/ F_{oo} AND MAX nvPM _{mass}	150.7	1.70E+15	2492
AS % OF CAEP/10 LIMIT	-	-	64.4
AS % OF CAEP/11 LIMIT (InP)	43.4	40.7	
AS % OF CAEP/11 LIMIT (NT)	70.4	61.1	

MEASURED DATA

MODE	POWER SETTING (% F_{oo})	TIME minutes	FUEL FLOW kg/s	EMISSIONS INDICES*		NVPM MASS CONCENTRATION PEAK nvPM _{mass} ($\mu\text{g}/\text{m}^3$)
				EI _{mass} (mg/kg)	EI _{num} (particles/kg)	
TAKE-OFF	100	0.7	2.605	63.4	2.45E+14	
CLIMB OUT	85	2.2	2.157	75.5	3.58E+14	
APPROACH	30	4.0	0.721	60.8	1.01E+15	
IDLE	7	26.0	0.255	6.6	4.16E+14	
LTO TOTAL (kg, mg, number of particles)			965	41582	4.69E+17	-
NUMBER OF ENGINES				2	2	2
NUMBER OF TESTS				3	3	3
AVERAGE LTO/ F_{oo} VALUES (mg/kN, particles/kN)				122.8	1.38E+15	-
MAX EI VALUES (mg/kg, particles/kg) AND MAX MASS CONC. ($\mu\text{g}/\text{m}^3$)				104.0	1.14E+15	2125

* Emissions Indices are corrected for thermophoretic loss and fuel hydrogen content

DATA FOR EMISSIONS INVENTORIES (ESTIMATIONS FOR ENGINE EXIT PLANE VALUES)

MODE	POWER SETTING (% F_{oo})	CORRECTED EMISSIONS INDICES	
		EI _{mass_SL} (mg/kg)	EI _{num_SL} (particles/kg)
TAKE-OFF	100	68.5	3.24E+14
CLIMB OUT	85	82.4	5.60E+14
APPROACH	30	71.5	2.51E+15
IDLE	7	8.8	1.04E+15

AMBIENT CONDITIONS

	From	To	FUEL	
BAROMETER (kPa)	99.7	100.5	HEAT OF COMBUSTION (MJ/kg)	43.12
TEMPERATURE (K)	276.6	286.7	HYDROGEN CONTENT (%mass)	13.75
HUMIDITY (kg water/kg dry air)	0.0024	0.0112	AROMATICS CONTENT (%vol)	17.8
			NAPHTHALENE CONTENT (%vol)	1.67
			SULPHUR CONTENT (ppm by mass)	365

MANUFACTURER: Rolls-Royce plc
 TEST ORGANIZATION: Rolls-Royce plc
 TEST LOCATION: Derby
 TEST DATES: 18/11/2015-25/04/2016

REMARKS

1. Certification Report EDNS01000750023
2. The maximum EI_{mass} occurs between 30% and 85% F_{oo}
3. Corrected peak EI number value (fuel correction) since EEDB v30